The Impact of Agriculture on Children At Risk in Rural Missouri

Research Report 0801-1
August 2001

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Key Findings

Decades of research have identified agriculture as a key ingredient in rural development (Green 1985; Heffernan 1982; Lobao et al. 1993). These studies have linked the structure of agriculture to the quality of economic and social conditions within a community.

First, it was found that higher percentages of the population engaged in agriculture as a primary occupation resulted in lower children at risk scores in 2000. This finding lends support to the Goldschmidt Hypothesis, which states that communities composed mainly of family farms are more socially developed than those composed mainly of industrial farms.

Second, increases in the interaction between percent population with a college degree and per capita income lowered children at risk scores in 2000. There is strong evidence that communities with higher levels of education are more likely to have a lower incidence of children at risk (Ellwood 2000; Nord 1997). This may be attributable to differences in occupation and income, both of which are tied to educational attainment.

Third, persistently poor counties had higher children at risk scores in 2000. There is strong evidence that poverty increases the incidence of children at risk in both rural and urban areas (Findes and Jensen 1998; Nord 1997). Therefore, areas with historically high levels of poverty would produce an at risk environment for children.

Lastly, higher percentages of workers employed in corporate agriculture resulted in higher children at risk scores in 2000. Again, this finding lends support to the Goldschmidt Hypothesis, which states that communities composed mainly of industrial farms are less socially developed than those composed mainly of family farms.

Interestingly, it appears that concentrations of workers employed in other traditional rural industries did not affect social conditions in rural Missouri.

The results of this analysis indicate that agricultural structure, education and income play a significant role in explaining the incidence of children at risk in rural Missouri.

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Analysis and reporting by David J. Peters.

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I. Overview

A central question within many economic development agencies is whether the economy has any impact on various social conditions. Numerous studies have demonstrated the link between social conditions and economic conditions within a region (Kusmin 1994; Kusmin et al. 1996). However, these studies fail to account for the different types of economic structures within a locality (Bartik and Eberts 1999). For example, is fast job growth in low wage and low skill industries better for a locality than slow job growth in high wage and high skill industries? There is a growing body of research demonstrating that the type of economic structure within a locality can produce both positive and negative externalities (Barnes and Blevins 1993; Findes and Jensen 1998). Examples of positive externalities include low levels of pollution, a highly skilled and educated labor force, and a higher quality of life. Examples of negative externalities include high levels of pollution, a poorly skilled and educated labor force, and a poorer quality of life. This association between the type of economic structure and social conditions extends to all sectors of the economy, including agriculture.

Decades of research have identified agriculture as a key ingredient in rural development (Green 1985; Heffernan 1982; Lobao et al. 1993). These studies have linked the structure of agriculture to the quality of economic and social conditions within a community. Such research began in the 1940s with Walter Goldschmidt's (1978) classic study of two agricultural communities in California. Goldschmidt concluded that communities with absentee-owned industrial farms were less developed both economically and socially than similar communities composed of mainly family farms. This argument is termed the Goldschmidt Hypothesis. It has been argued that an industrial structure of agriculture creates inequalities between a small number of managers and a large number of economically dependent wage laborers. As a result, the future of these wage laborers and the community itself is dependent on absentee-owners. By contrast, economically independent farm families own the land they work on and make managerial decisions regarding farm operations. As a consequence, the future of farming communities rests in the hands of its citizens, rather than on absentee-owned firms. Researchers have argued that this is the key difference which accounts for the disparities in rural economic and social conditions (Bender et al. 1985).

Although there has been numerous studies linking the structure of agriculture to economic conditions, there is a dearth of research linking the structure of agriculture to social conditions (Lobao and Schulman 1991; Nord 1997). Further, much of the existing literature linking the structure of agriculture to social conditions is not empirically grounded (Heffernan 1982). Therefore, the objective of this analysis is to empirically determine how the structure of agriculture impacts social conditions in rural Missouri.

II. Methods

Indicator of Children At Risk

To begin with, an adequate indicator of social conditions within a county needed to be selected. Researchers have devised a plethora of methods to quantify social indicators (Ellwood 2000; Kusmin et al. 1994; Nord 1997). However, many of these methods are limited in terms of data availability, regional specificity, and statistical reliability. In order to address these limitations, an indicator of children at risk was developed. This indicator will allow policy makers to track the current state of child well-being at the county level over time.

The data used to create this social indicator is from KidsCount Missouri, which is supported by the Office of Social and Economic Data Analysis at the University of Missouri and the Annie E. Casey Foundation. The data is available at the county level and has been collected on an annual basis since 1995. The KidsCount Missouri data offers the most consistent tracking of child and teen well-being in Missouri. Eight variables were selected for analysis and factor analytic techniques were applied to reduce the variables into distinct indices. Refer to Appendix A for detailed information on the variables.

Both principle components analysis (PCA) and principle factor analysis (PFA) are statistical techniques applied to a single set of variables where the researcher is interested in discovering which variables in the set form coherent subsets that are relatively independent of one another. Variables that are correlated with one another but largely independent of other subsets of variables are combined into factors. Factors are thought to reflect the underlying processes that have created the correlations among variables. The axis is often rotated to maximize variance or covariance between factors.

The data met the assumptions to be considered factorable. All eight variables exhibited moderately high correlations (r=0.60 and above), and the Kaiser -Meyer-Olkin Measure of Sampling Adequacy was high (*KMO*=0.60 and above). An initial PCA was run using oblique rotation, which resulted in no interfactor correlations indicating that an orthogonal rotation was necessary. The PCA orthogonal rotation (varimax method) resulted in three distinct factors, as indicated by Eigen values (*Eigen*=1.0 and above).

The three factors accounted for 70.14% of the variance on the initial eight variables - indicating a good factor solution. Since Drop Out Rates cross loaded on Factors 1 and 3, it was dropped from the solution. Once grouped into factors, variable scores were z-normalized to remove the effect of different scales. Indices were created by summing the z-scores for each index. Reliability analysis was then conducted on each index to ensure consistency. Refer to Table 2.1.

Table 2.1
Factor Solution - Orthogonal Rotation

VARIABLE	Children At Risk	Child Abuse/Neglect	Teen Violent Death
Births to Mothers No High School Degree	**.850**	.063	.205
Low Birth Weight Infants	**.699**	.134	-.159
Probable Cause Child Abuse/Neglect	.231	**.758**	-.208
Out-of-Home Placements Entries	.164	**.827**	.178
Drop Out Rate	*.583*	*.110*	*-.524*
Teen Birth Rate	**.809**	.287	.059
Teen Violent Death Rate	.144	.033	**.878**
Children on Food Stamps	**.794**	.319	.063
EIGEN VALUE	**2.939**	**1.477**	**1.195**
PERCENT CUMULATIVE VARIANCE EXPLAINED	**36.734**	**55.198**	**70.136**
ALPHA RELIABILITY	**.717**	**.682**	**-**

The results of the factor analysis indicate three distinct indices. For this analysis, the *Index of Children At Risk* is used to measure child well-being in Missouri. This index measures the environmental conditions present that may affect the economic and social well-being of children. The index is comprised of four variables: births to mothers without a high school degree; low birth weight infants; teen birth rate; and children on food stamps. This index has an alpha reliability of a=0.72.

Prediction Model

Ordinary Least Squares (OLS) regression is used to delineate factors that predict children at risk in rural Missouri in 2000. The predictors selected are those factors that are most likely to affect child well-being in rural areas, including economic and structure of agriculture variables. Although many variables could have been included in the model, only the strongest determinants of child well-being identified in the literature have been used. All metropolitan counties (N=22) were excluded from the analysis, based on U.S. Census Bureau definitions.

Missouri Metropolitan Areas

OLS regression centers on the notion that we wish to predict the value on some variable (known as the endogenous variable) knowing the values of several other variables (known as exogenous variables). Usually, the best guess for predicting a value on the endogenous variable is the mean, but this produces some amount of error due to the inaccuracy of prediction. Regression improves this accuracy by taking into account additional information (control and predictor exogenous variables) in order to more accurately predict values on the endogenous variable.

The OLS model was run on N=93 rural counties in Missouri. The general model used to predict children at risk is given in equation (1). All assumptions were met for the coefficients to be the best linear unbiased estimates. Refer to Appendix B for more information regarding the econometric technique.

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 \text{IEDUPCI} + \hat{\beta}_2 \text{MFGRPCT} + \hat{\beta}_3 \text{PSRVPCT} + \hat{\beta}_4 \text{RETPCT} + \hat{\beta}_5 \text{GOVTPCT} + \hat{\pi}_6 \text{PERPOOR} + \hat{\beta}_7 \text{CAGRPCT} + \hat{\beta}_8 \text{FARMPCT} + \hat{\upsilon} \quad (1)$$

The endogenous variable used in the analysis is the Index of Children at Risk in 2000. This variable is a social indicator of child well-being within a county. Data is taken from KidsCount Missouri, from the Office of Social and Economic Data Analysis at the University of Missouri and the Annie E. Casey Foundation.

IEDUPCI is an interaction term between percent of population aged 25 an older with a college degree in 1999 and per capita income in 1999. Since these two variables were highly correlated, an interaction term was created to minimize multicollinearity (Gujarati 1995). Educational attainment data is taken from the Missouri Department of Elementary and Secondary Education, and per capita income data is taken from the Bureau of Economic Analysis. This is a control variable measuring human capital and income wealth within a county. Other variables such as population density and distance to metropolitan areas were dropped because of high correlations with other exogenous variables, which may have introduced multicollinearity.

MFGRPCT is the percent of employment in manufacturing; PSRVPCT is the percent of employment in personal services; RETPCT is the percent of employment in retail trade; and GOVTPCT is the percent employment in local, state and federal government. The above data is by place-of-work and is taken from Covered Employment and Wages from the Missouri Department of Economic Development. These variables measure the structure of the non-farm economy within a county.

PERPOOR is a dichotomous variable indicating whether a county was persistently poor in 1990. Persistently poor counties are those that had poverty rates of 20 percent or higher in 1960, 1970, 1980, and 1990. Data is from the Economic Research Services at the United States Department of Agriculture. This variable measures a county's historic poverty status.

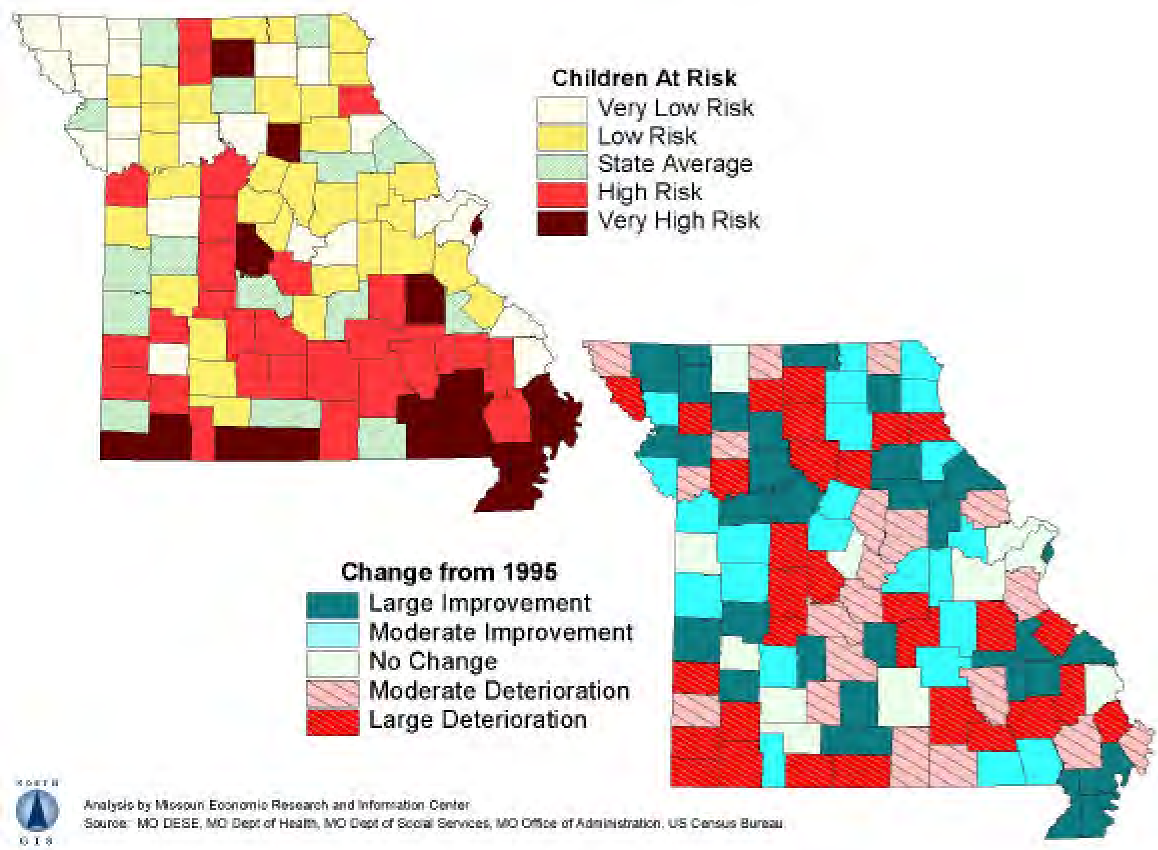
CAGRPCT is the percent employment in corporate agriculture. This variable measures the number of wage laborers engaged in livestock production (except dairy), poultry and egg production, and meat products manufacturing. Data is by place-of-work and is taken from Covered Employment and Wages from the Missouri Department of Economic Development. This variable measures the degree of industrial or wage-labor agriculture within a county.

FARMPCT is the percent population engaged in farming as a primary occupation in 2000. Farm operator data is from 1997 and was divided by 2000 county population to account for population growth. Although this is a mismatch of years, it was decided that the most current data available should be used to create the measure. Farm operator data is taken from the Census of Agriculture from the U.S. Department of Agriculture, and population was taken from the U.S. Census. FARMPCT includes all individuals spending 50% or more of their working time at farming, regardless of the scale of operation. Therefore, the data includes farmers regardless of acres or gross sales, and excludes corporate and recreational farms.

III. Overview of Children At Risk

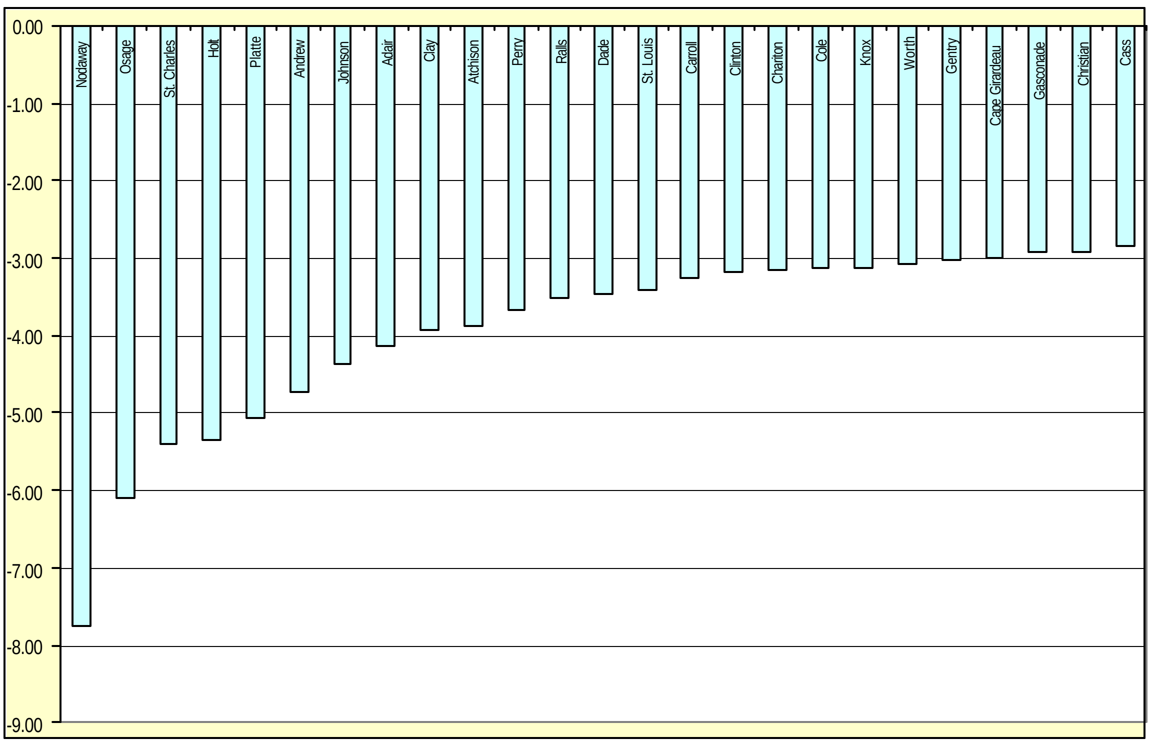
The Index of Children at Risk measures the environmental conditions present that may affect the economic and social well-being of children. High risk indicates that children may live in home environments which negatively impact a child's future well-being in terms of wage potential, educational attainment and health status. It appears that children are most at risk in southern Missouri, particularly in the Bootheel region. Children are least at risk in northwestern Missouri and in areas along the eastern portion of the Missouri River. Refer to Map 3.1.

Map 3.1
Children at Risk, 1995-2000



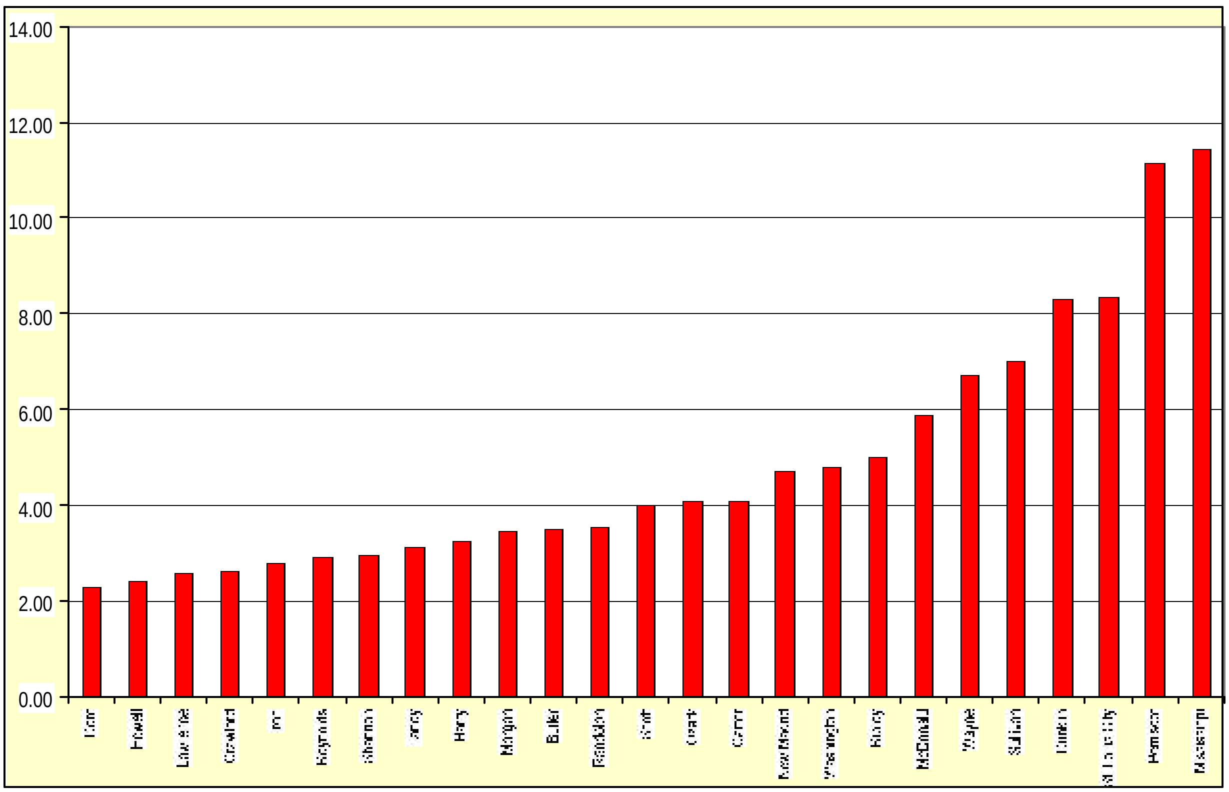
Children are least at risk in four main regions of the state: (1) northwest Missouri; (2) suburban St. Louis; (3) the Cape Girardeau region; and (4) areas along the eastern portion of the Missouri River. The five counties with the lowest risk levels are Nodaway, Osage, St. Charles, Holt, and Platte counties. Generally, suburban areas exhibit low risk because of higher income and educational levels (Ellwood 2000). The northwest region exhibits lower risk because the area is characterized by family-scale farms, which have historically provided stable, albeit lower incomes (Rhodes 1995). Refer to Chart 3.1.

Chart 3.1
Children at Risk - Low Risk Counties, 2000
Zero indicates the state average.



Children are most at risk in four main regions of the state: (1) the Bootheel region; (2) the City of St. Louis; (3) Sullivan County; and (4) most areas in the southern portion of the state. The five counties with the highest risk levels are Mississippi, Pemiscot, St. Louis City, Dunklin, and Sullivan counties. Historically, the Bootheel region has exhibited higher risk because it is classified as persistently poor (Nord 1997). More generally, southern Missouri exhibits higher risk because it has lower levels of income and education than the rest of the state. In Sullivan County, there are several livestock processing plants employing a large number of low-skill migrant workers, resulting in a higher risk factor (Grambling and Freudenberg 1992). Refer to Chart 3.2.

Chart 3.2
Children at Risk - High Risk Counties, 2000
Zero indicates the state average.



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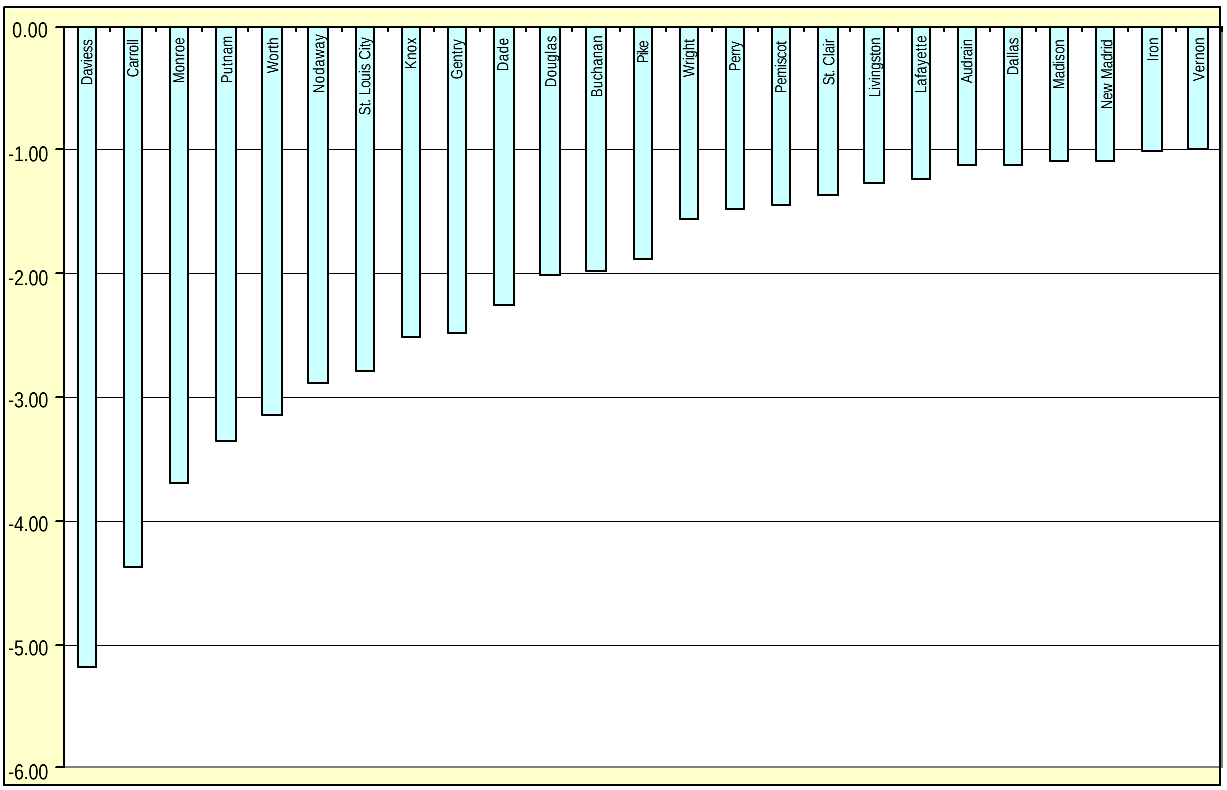
Since 1995, several counties have experienced marked improvement in their children at risk scores. Generally, these counties were concentrated in the Bootheel, west central Missouri, east central Missouri, and northwest Missouri. The five counties with the largest improvement since 1995 are Daviess, Carroll, Monroe, Putnam, and Worth counties. Improvement scores should be noted with caution in that it does not reflect current at-risk conditions. For example, although St. Louis City improved markedly since 1995, it still has the third highest risk level for children in 2000. Refer to Chart 3.3.

Chart 3.3
Children at Risk - High Improvement Counties, 1995-2000
Zero indicates the state average.



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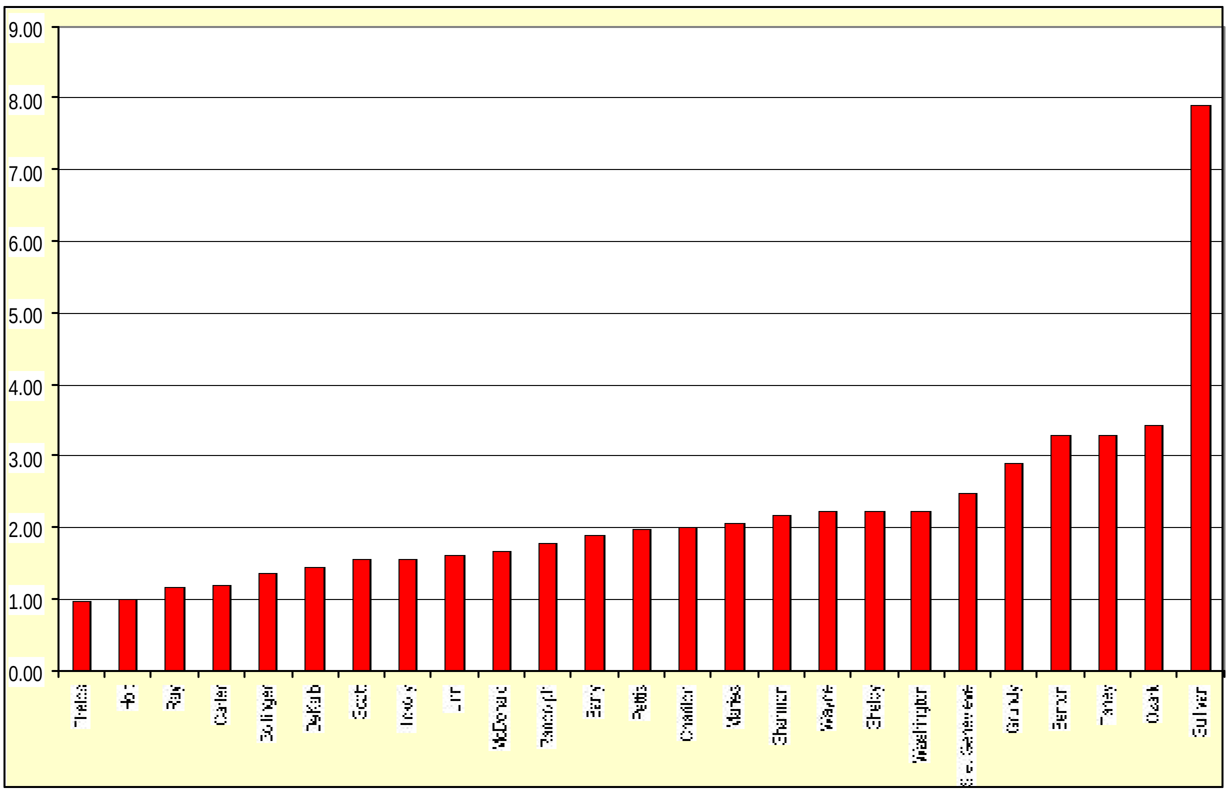
Since 1995, several counties have experienced marked deterioration in their children at risk scores. Generally, these counties were concentrated in southwest and central Missouri. The five counties with the largest deterioration since 1995 are Sullivan, Ozark, Taney, Benton, and Grundy counties. These areas are characterized by livestock processing (Milan and Trenton) and recreation/entertainment centers (Branson and Truman Reservoir). There is evidence to support the assertion that corporate agriculture and low wage services jobs contribute to lower socioeconomic conditions (Green 1985; Rhodes 1995). Refer to Chart 3.4.

Chart 3.4
Children at Risk - High Deterioration Counties, 1995-2000
Zero indicates the state average.



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IV. Structure of Agriculture and Children At Risk

Associations and Trends

By looking at all rural counties in Missouri, we find that increases in the percent population engaged in farming as a primary occupation decreases children at risk scores in 2000. The two variables exhibit a moderate association that is statistically significant (r=-0.389, p=0.000). The majority of the top farming counties also exhibited extremely low children at risk scores in 2000. Refer to Chart, Table and Map 4.1.

Chart 4.1
Children at Risk by Farmers as Primary Occupation, 2000
Zero indicates the state average. Positive values indicate higher risk to children.

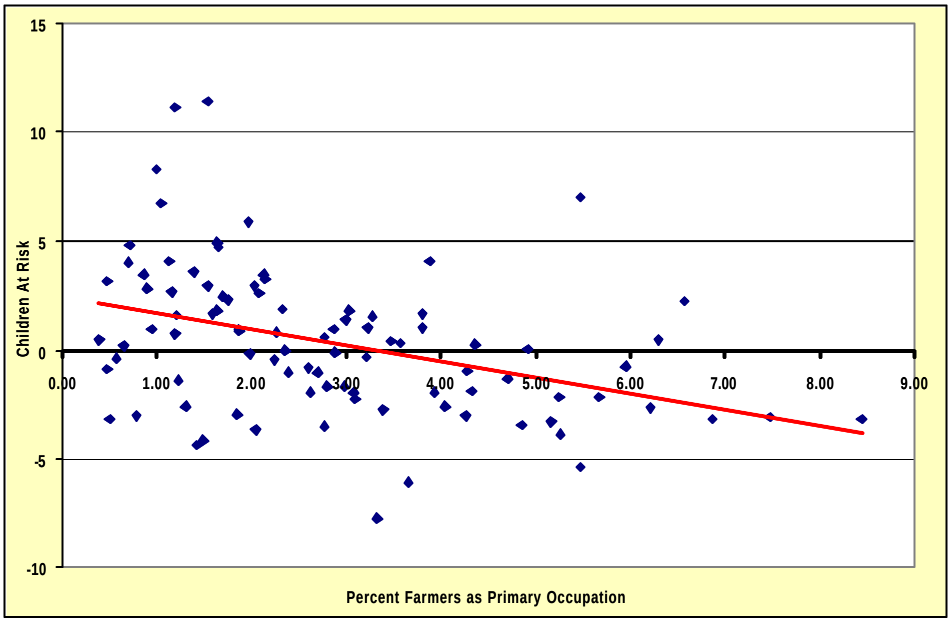
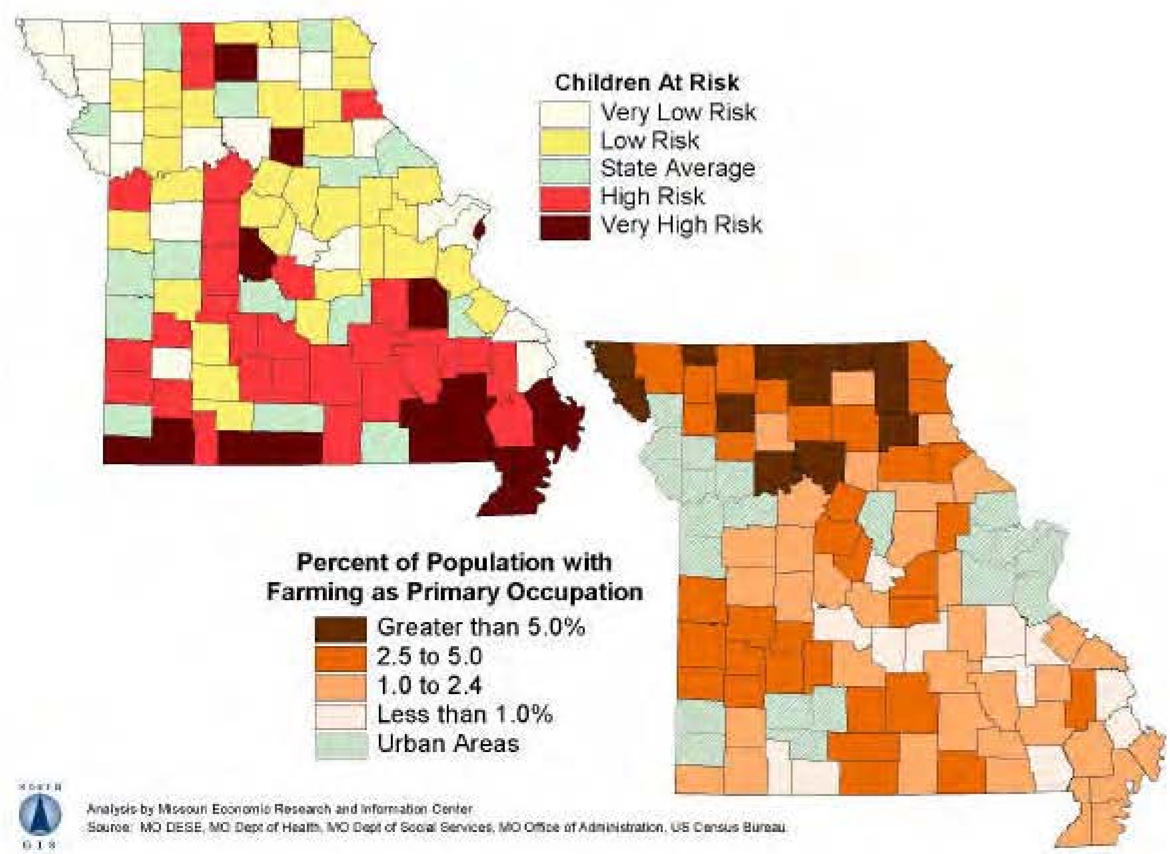


Table 4.1
Percent Population Farmers as Primary Occupation, 2000

Top Counties	Percent Farmers as Primary Occupation	Index of Children at Risk
Knox	8.44%	-3.13
Worth	7.47%	-3.07
Chariton	6.87%	-3.16
Mercer	6.57%	2.25
Scotland	6.30%	0.46
Schuyler	6.21%	-2.66
Putnam	5.95%	-0.75
Shelby	5.68%	-2.17
Holt	5.48%	-5.36
Sullivan	5.47%	7.03

Map 4.1
Children at Risk and Farmers as Primary Occupation, 2000



By looking at all rural counties in Missouri, we find that increases in the percent of workers employed in corporate agriculture increases children at risk scores in 2000. The two variables exhibit a moderately weak association that is statistically significant (r=0.206, p=0.048). The majority of the top corporate agriculture counties also exhibited extremely high children at risk scores in 2000. Refer to Chart, Table and Map 4.2.

Chart 4.2
Children at Risk by Corporate Agriculture, 2000
Zero indicates the state average. Positive values indicate higher risk to children.

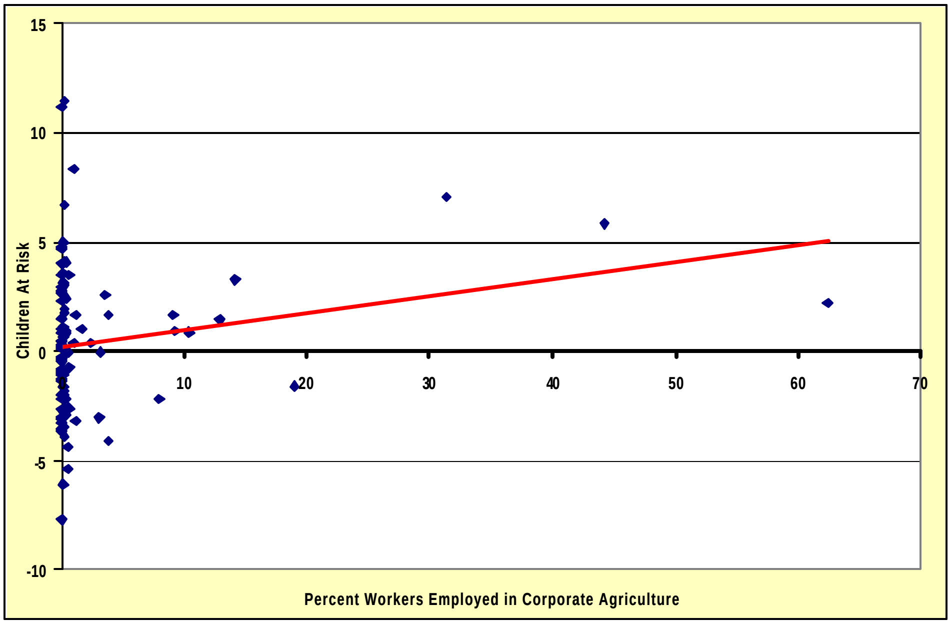
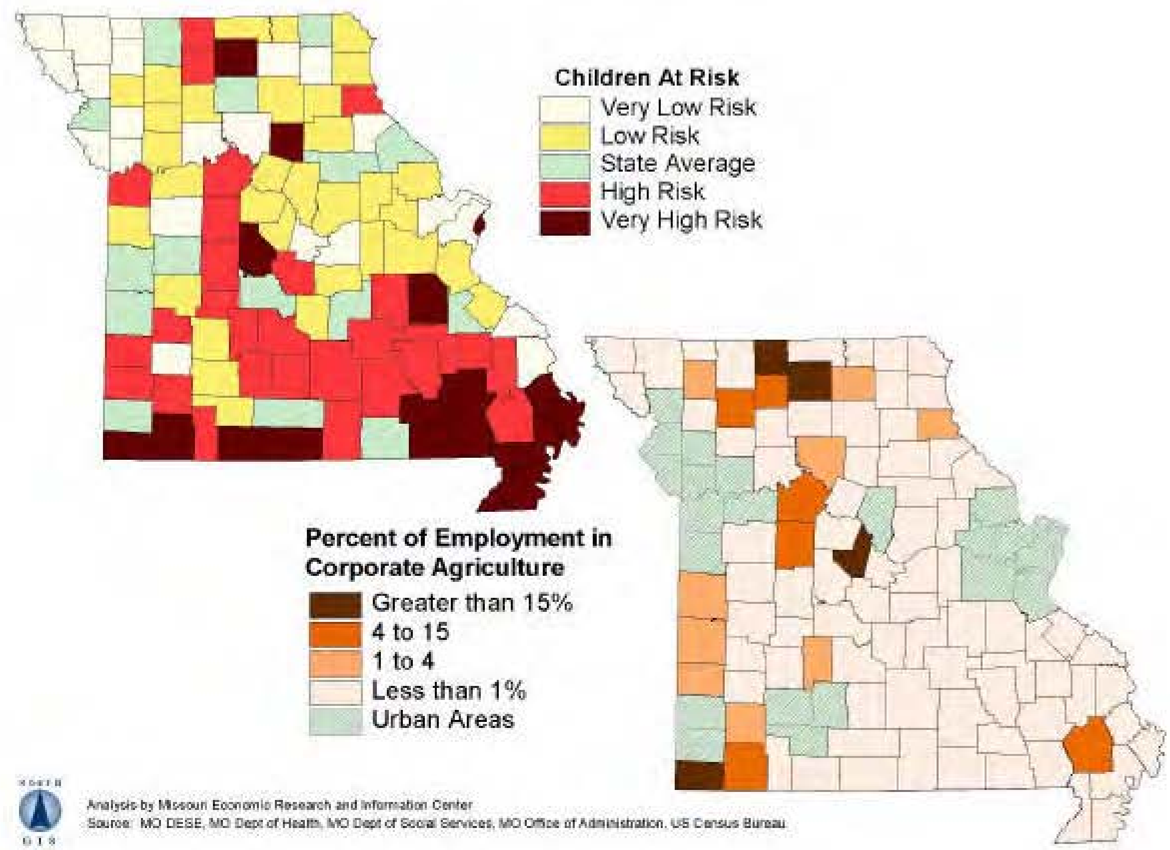


Table 4.2
Percent Employment in Corporate Agriculture, 2000

Top Counties	Percent Employed in Corporate Agriculture	Index of Children at Risk
Mercer	62.47%	2.25
McDonald	44.24%	5.87
Sullivan	31.31%	7.03
Moniteau	19.01%	-1.64
Barry	14.17%	3.25
Grundy	12.95%	1.42
Saline	10.33%	0.85
Stoddard	9.18%	0.97
Pettis	9.05%	1.66
Daviess	8.01%	-2.19

Map 4.2
Children at Risk and Corporate Agriculture, 2000



By looking at all rural counties in Missouri, we find that increases in the percent population with a bachelors degree or higher decreases children at risk scores in 2000. The two variables exhibit a moderately strong association that is statistically significant (r=-0.422, p=0.000). The majority of the top college educated counties also exhibited extremely low children at risk scores in 2000. Refer to Chart, Table and Map 4.3.

Chart 4.3
Children at Risk by Percent Population College Graduates, 2000
Zero indicates the state average. Positive values indicate higher risk to children.

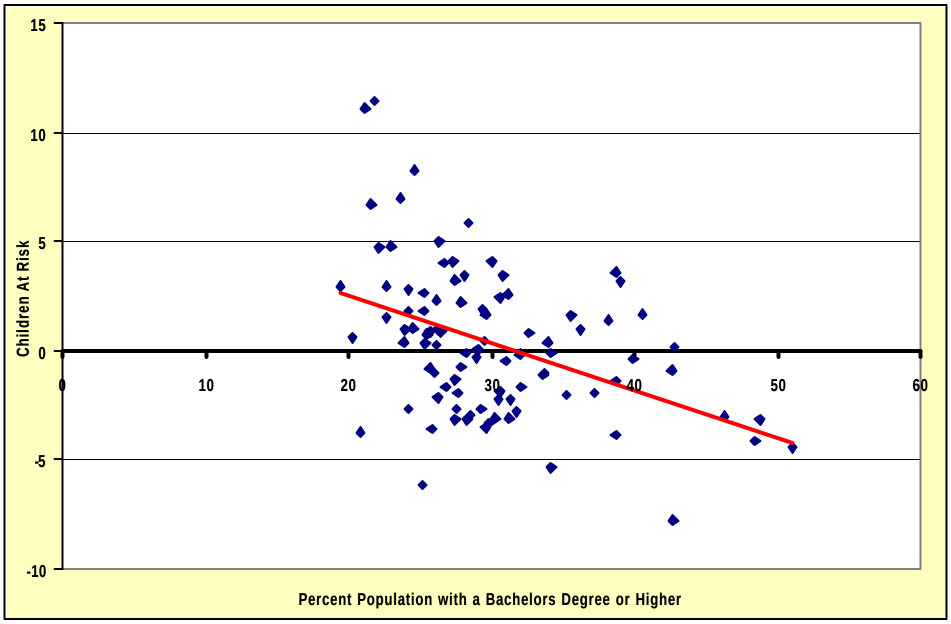
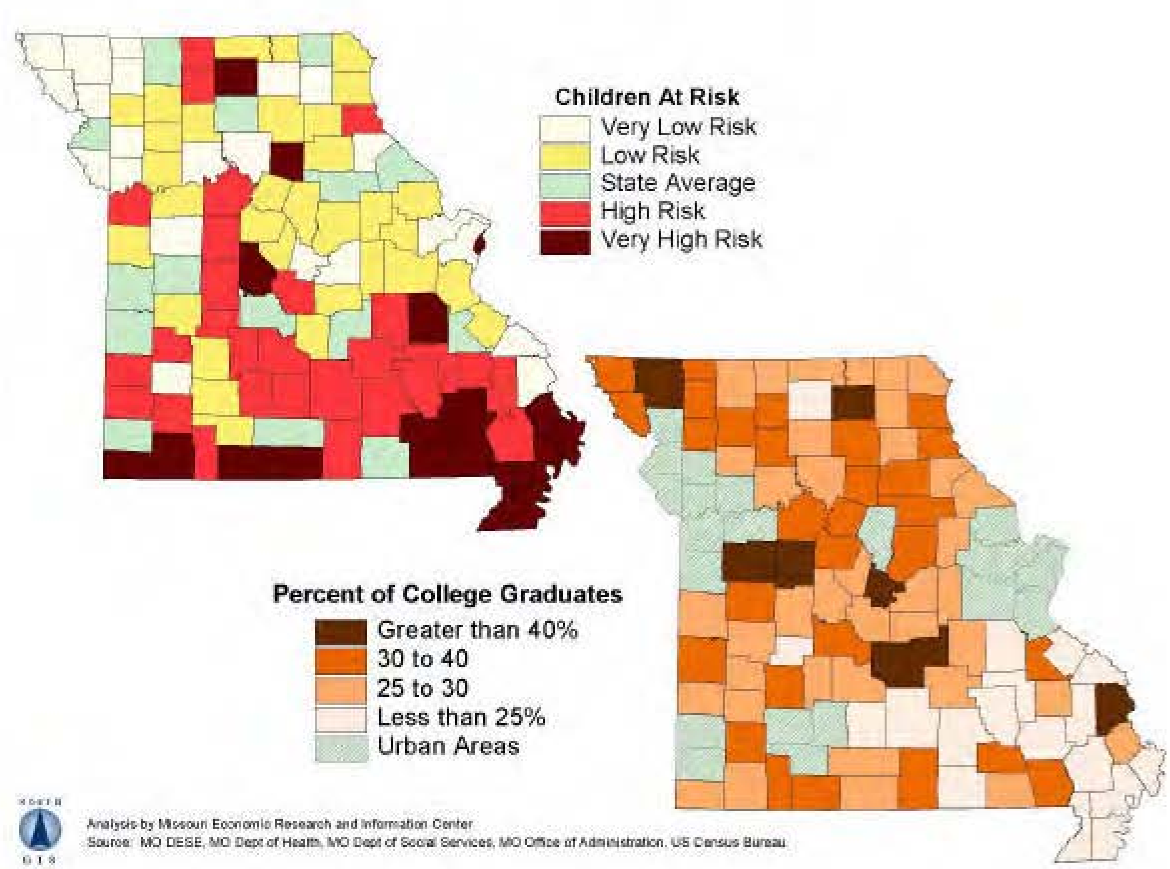


Table 4.3
Percent Population College Graduates, 2000

Top Counties	Percent Population College Graduates	Index of Children at Risk
Johnson	51.08%	-4.37
Cole	48.79%	-3.14
Adair	48.41%	-4.13
Cape Girardeau	46.24%	-3.01
Phelps	42.85%	0.18
Nodaway	42.74%	-7.75
Pulaski	42.64%	-0.88
Pettis	40.53%	1.66
Camden	39.84%	-0.37
Taney	39.05%	3.15

Map 4.3
Children at Risk and Percent Population College Graduates, 2000



By looking at all rural counties in Missouri, we find that increases in per capita income decreases children at risk scores in 2000. The two variables exhibit a moderate association that is statistically significant (*r*=-0.306, *p*=0.003). The majority of top per capita income counties also exhibited low children at risk scores in 2000. Refer to Chart, Table and Map 4.4.

Chart 4.4
Children at Risk by Per Capita Income, 2000
Zero indicates the state average. Positive values indicate higher risk to children.

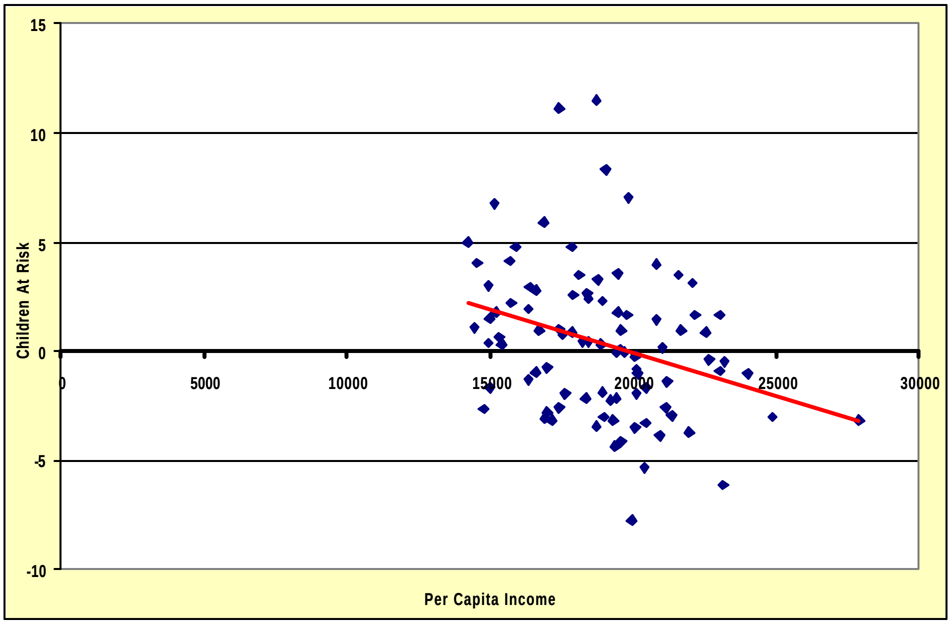


Table 4.4
Per Capita Income, 2000

Top Counties	Per Capita Income	Index of Children at Risk
Cole	$27,884	-3.14
Cape Girardeau	$24,886	-3.01
Livingston	$24,013	-1.04
Audrain	$23,175	-0.47
Osage	$23,143	-6.10
Pulaski	$23,039	-0.88
Pettis	$23,018	1.66
Camden	$22,667	-0.37
Saline	$22,556	0.85
Marion	$22,188	1.63

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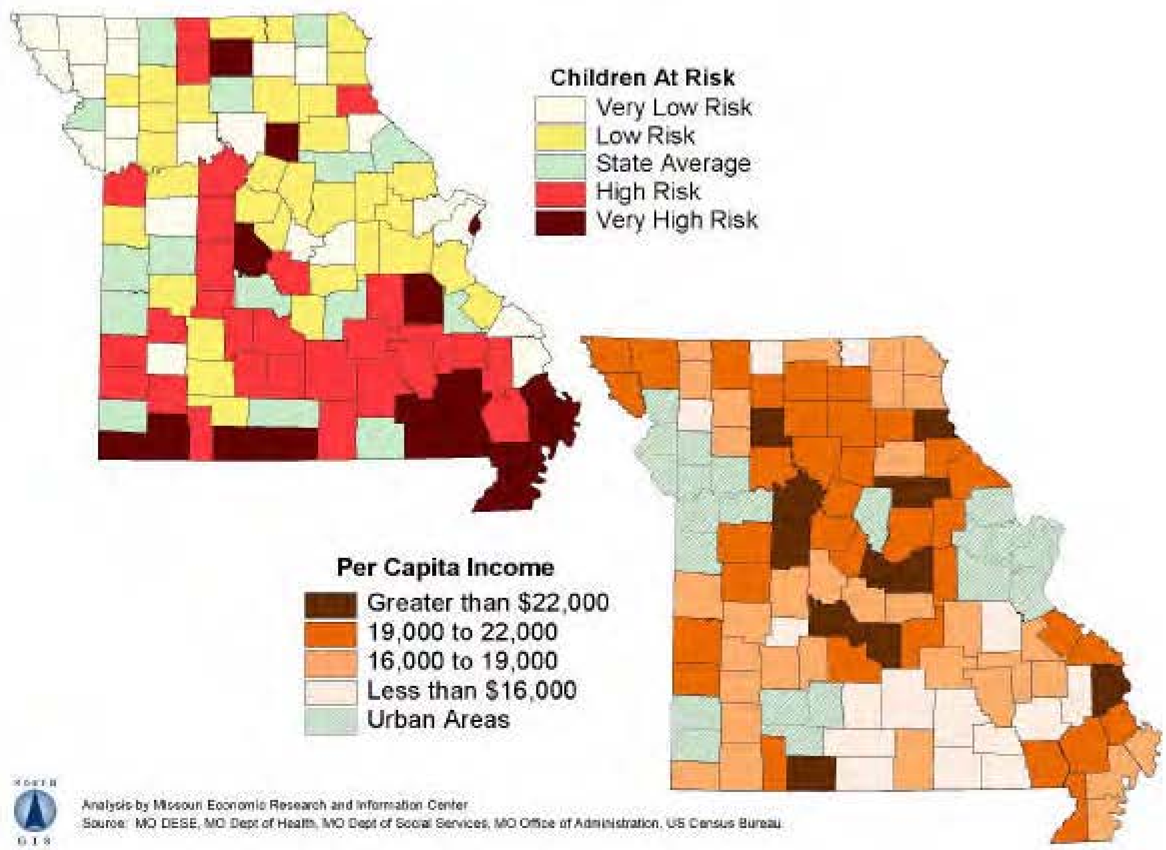
Map 4.4
Children at Risk and Per Capita Income, 2000



Predicting Children At Risk

To determine how economic and structure of agriculture factors influence children at risk, an OLS regression model predicting children at risk scores was run on N=93 rural counties in Missouri. The model predicts children at risk scores with a high degree of accuracy ($F_{8,92}$=18.363, p=0.0001). Approximately 60% ($R^2_{adjusted}$ = 0.602) of children at risk scores in rural Missouri can be explained by four factors, listed in order by strength of association. Refer to Table 4.5.

Table 4.5
OLS Regression Model Predicting
Children at Risk in Rural Missouri, 2000 (N=93)

VARIABLE	PARAMETER ESTIMATES		
	Estimate	Std Estimate	Significance
INTERCEPT	4.287	0.000	0.094
Interaction between college graduates and per capita income	***-0.001	***-0.409	***0.000
Percent Employed in Manufacturing	-0.009	-0.029	0.773
Percent Employed in Personal Services	0.087	0.126	0.153
Percent Employed in Retail Trade	0.063	0.094	0.278
Percent Employed in Government	-0.005	-0.014	0.889
Persistently Poor in 1990	***2.770	***0.367	***0.000
Percent Employed in Corporate Agriculture	***0.126	***0.329	***0.000
Percent Population Farmers as Primary Occupation	***-0.926	***-0.485	***0.000
F (8,92)	***18.363		
Adjusted R^2	0.602		
Durbin-Watson *d*	2.150		
White's χ^2	51.219		

Source: Missouri Economic Research and Information Center.

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

First, it was found that higher percentages of the population engaged in agriculture as a primary occupation resulted in lower children at risk scores in 2000 (ß*=-0.485, *p*=0.0001). This finding lends support to the Goldschmidt Hypothesis, which states that communities composed mainly of family farms are more socially developed than those composed mainly of industrial farms. It has been argued by Green (1985) and Heffernan (1982) that family farms produce positive externalities because they are economically independent, spend more money within the local economy, and participate more in civic associations and local government. In addition, farm families are generally closely knit because family and business environments are intertwined and children are more closely supervised - leading to better child outcomes (Salamon 1992).

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Second, increases in the interaction between percent population with a college degree and per capita income lowered children at risk scores in 2000 (ß*=-0.409, *p*=0.0001). There is strong evidence that communities with higher levels of education are more likely to have a lower incidence of children at risk (Ellwood 2000; Nord 1997). This may be attributable to differences in occupation and income, both of which are tied to educational attainment.

Third, persistently poor counties had higher children at risk scores in 2000 (ß*=0.367, *p*=0.0001). There is strong evidence that poverty increases the incidence of children at risk in both rural and urban areas (Findes and Jensen 1998; Nord 1997). Therefore, areas with historically high levels of poverty would produce an at risk environment for children.

Lastly, higher percentages of workers employed in corporate agriculture resulted in higher children at risk scores in 2000 (ß*=0.329, *p*=0.0001). Again, this finding lends support to the Goldschmidt Hypothesis, which states that communities composed mainly of industrial farms are less socially developed than those composed mainly of family farms. It has been argued that an industrial structure of agriculture creates inequalities between a small number of managers and a large number of economically dependent wage laborers (Green 1985; Heffernan 1982). As a result, the future of these wage laborers and the community itself is dependent on absentee-owners.

Interestingly, it appears that concentrations of workers employed in other traditional rural industries did not affect social conditions in rural Missouri. Percent employment in manufacturing, government, retail trade and personal services did not have any significant impact on children at risk. This may indicate that although non-agricultural industries have a significant impact in terms of economic conditions, they do not have much impact on social conditions. In essence, agriculture appears to exert a strong effect on the social environment in rural Missouri.

IV. Implications and Summary

Decades of research have identified agriculture as a key ingredient in rural development (Green 1985; Heffernan 1982; Lobao et al. 1993). These studies have linked the structure of agriculture to the quality of economic and social conditions within a community. Such research began in the 1940s with Walter Goldschmidt's (1978) classic study of two agricultural communities in California. Goldschmidt concluded that communities with absentee-owned industrial farms were less developed both economically and socially than similar communities composed of mainly family farms. The results of this analysis support Goldschmidt's argument.

It was found that structure of agriculture does affect the social conditions within rural counties in Missouri, with independent farms having the most positive social impact. Rural counties with higher percentages of the population engaged in farming as a primary occupation resulted in lower children at risk scores in 2000. This indicates that farming, regardless of the scale of operation, produces positive social externalities. In contrast, rural counties with higher percentages of workers employed in corporate agriculture resulted in higher children at risk scores in 2000. This indicates that wage-labor agriculture produces negative social externalities. These two findings provide empirical support for the Goldschmidt Hypothesis in rural Missouri. However, the data also indicates that increases in corporate agriculture do not always result in decreases in numbers of farmers. Several counties simultaneously had high concentrations of corporate agriculture employment and primary occupation farmers. Regardless, the evidence demonstrates that corporate agriculture creates conditions that place children more at risk, while farming creates conditions that place children less at risk.

In addition, it was found that large concentrations of college graduates and higher per capita incomes resulted in lower children at risk scores in 2000. This indicates that high educational attainment and increased wealth, both or which are highly related, produce an environment where the incidence of children at risk is low. Related to this, it was found that persistently poor rural counties had increased children at risk scores in 2000. This indicates that areas with historically high poverty levels have a greater incidence of children at risk.

In summary, it appears that children are least at risk in rural areas that have high concentrations of farmers as primary occupation, higher concentrations of college graduates, higher per capita incomes, and lower concentrations of corporate agriculture employment. It appears that the other sectors of the economy do not play a significant role in affecting children at risk scores. The results of this analysis indicate that agricultural structure, education and income play a significant role in explaining the incidence of children at risk in rural Missouri.

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Appendix A - Social Indicators

Births to Mothers without a High School Diploma – number of live births that occur to women who have less than 12 years of education as indicated on birth certificates. Rate is expressed as a percent of all live births. *Source: Missouri Department of Health*.

Low Birth Weight Infants – number of live infants recorded as having a birth weight under 2,500 grams (5.5 pounds). Rate is expressed as percent of total live births. Data were aggregated over five year periods in order to provide more stable rates. *Source: Missouri Department of Health*.

Probable Cause Child Abuse/Neglect – number of child abuse victims from reports classified as probable cause, indicating that child abuse or neglect has occurred. Rate is expressed per 1,000 children. *Source: Missouri Department of Social Services, US Bureau of the Census, Missouri Office of Administration*.

Out-of-Home Placement Entries– number of entries into Division of Family Services alternative care: including foster care, group homes, relative care and residential settings. Rate is expressed per 1,000 children. *Source: Missouri Department of Social Services, US Bureau of the Census, Missouri Office of Administration*.

High School Dropout Rate – number of students enrolled in public schools who left school without graduating during the school year. Rate is expressed as percent of enrolled students. The formula used to calculate the rate accounts for transfers in and out of a district*. Source: Missouri Department of Elementary and Secondary Education*.

Teen Birth Rate – number of live births that occur to females ages 15 to 19. Rate is expressed per 1,000 females of that age group. *Source: Missouri Department of Health, Missouri Office of Administration*.

Teen Violent Death Rate – number of deaths from homicides, suicides, motor vehicle crashes and other accidents to teens ages 15 to 19. Rate is expressed per 100,000 teens of that age group. Data were aggregated over five year periods in order to provide more stable rates. *Source: Missouri Department of Health, US Bureau of the Census, Missouri Office of Administration*.

Children on Food Stamps – percentage of population under 18 that live in households receiving food stamp benefits. *Source: Missouri Department of Social Services, US Bureau of the Census, Missouri Office of Administration*.

Appendix B - Econometric Methodology

Generally speaking, regression centers on the notion that we wish to predict the value on some variable (known as the endogenous variable) knowing the values of several other variables (known as exogenous variables). Usually, the best guess for predicting a value on the endogenous variable is the mean, but this produces some amount of error due to the inaccuracy of prediction. Regression improves this accuracy by taking into account additional information (control and predictor exogenous variables) in order to more accurately predict values on the endogenous variable. By doing so, you reduce the amount of error associated with only predicting the mean. Therefore, an Ordinary Least Squares (OLS) regression equation is a mathematical representation of an estimation rule that seeks to minimize the amount of error in prediction. Also, regression deals with the dependence of one variable on other variables, so it does not establish true causation. Regression is a stochastic process in which there is some error in prediction and estimation.

The results of the regression model are the best linear unbiased estimates, since they meet the key assumptions of OLS regression.

(1) *Random Endogenous Variable*: the values of the endogenous variable were produced by chance, and were not chosen a priori.

(2) *Normal Endogenous Variable*: the endogenous variable had a normal probability distribution, with skewness and kurtosis less than 2.0.

(3) *Linearity*: plots of each exogenous variable by each endogenous variable showed no curvilinear pattern.

(4) *Independent Errors*: the error terms for the OLS model were not correlated, a possible problem with time-series data. The Durbin-Watson statistic was run on the OLS model, and values were around 2.00 indicating no serial correlation (Durbin-Watson d fell between d_U=1.877 and $4\text{-}d_U$=2.123).

(5) *Homoscedasticity*: the variance of the error terms for the OLS model were constant across the full range of the exogenous variable. White's test was not significant for the OLS model, indicating that generalized heteroscedasticity is not present. Plots of the residuals of the endogenous variables by each exogenous variable revealed normally distributed error terms, indicating that systematic heteroscedasticity is not present.

(6) *No Multicollinearity*: no linear relationships were found among the variables. An examination of the correlation matrix indicated no r-value above 0.55.

(7) *Model Specified Correctly*: the variables chosen for the model have been validated by other researchers (Kusmin et al. 1996; Kusmin 1994).

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